ticular claim of extraordinary merit for the exercise of his talent and industry. He had performed a duty, and was, he thought, still discharging one in exerting himself to push forward the results for the benefit of the public, from which he of course might derive his own legitimate reward. Many, he remarked, were the inventors who complained of want of due patronage, but in many cases, he feared, the fault lay largely with themselves. We fear so too—but cold comfort lies in such a conclusion. We fear it, but we feel it more. We are resolved to give counsel in our best fashion to remedy it. It were as good to do this almost as to cure all the smoky chimneys.

ON ECONOMICAL COMBUSTION AND EVAPORATION.

BY MR. HENRY DIBCES, FURNACE ARCHITECT AND ENGINEER.

(*Communicated to the Pharmaceutical Society, October*, 1843.)

A KNOWLEDGE of the chemistry of combustion can alone lead to the economical producing and applying of heat from any kind of fuel. The only work in which this subject is thoroughly examined, both chemically and practically, is the excellent treatise on the combustion of coal,* by Mr. C. W. Williams, in which is pointed out the source of error in many of the expedients which have been contrived for "smoke burning," all of these being more or less deficient of the means for consuming the gaseous products of the fuel; while great ingenuity is displayed in their contrivances for excluding air and providing a mass of incandescent fuel in or over which the smoke is to be burnt, that smoke which is merely the result and evidence of imperfect combustion. These smoke-burning processes are generally abundant generators of carbonic oxide, and this flying off, becomes one source of waste, while the expenditure of heat in producing it becomes another, and the destruction of the furnace, in conducting the operation, a third, and most serious one to the manufacturer.

The leading feature developed in Mr. Williams's treatise is, that if gas in jets be supplied with air, or air in jets be supplied with gas, combustion will be perfect, and a smokeless flame produced. In close furnaces, the gaseous products of the fuel can only get air through the grate bars, the doorway, or some accidental inlet; but in no common furnace can the supply of air be adequate for the complete combustion of the gas. Mr. Williams provides this needful supply through a perforated air distributor, carrying the air into and mixing it intimately with, the large volume of gas, producing bright instead of dark smoky flame, and consequently the gas is burnt, and smoke prevented. From its near approach to the principle of the Argand lamp, this plan has been designated the Argand furnace; in the one we see jets of gas thrown into air, in the other, numerous jets of air thrown into an atmosphere of gas; stop ever so partially the admission of air to either, and smoke is instantly produced; both aim at obtaining extent of surface to secure better diffusion and more intimate union.

The crude, impure, coal-gas evolved immediately after each fresh charge of fuel, without this supply of air thus judiciously given, would, by being only partially burnt, be wasted in the form of smoke, which, fouling the exterior surface of the vessel, considerably lowers its evaporating power, while at the same time, as a necessary consequence, much of the available heat of the gaseous fuel is lost, and dependence placed only on that given off by the solid incandescent fuel. The efficacy of the plan now under consideration is placed beyond a doubt by the fact of 320 having been successfully erected during the last eighteen months for land-engine furnaces, and the same arrangement put on board no less than twenty-five steamers, providing practically what we know to be correct in theory, and which is further sanctioned by the testimony of Doctors Brand, Ure, Kane, and other distinguished authorities.

Next to the obtaining of perfect combustion, much attention has been paid by many to means for increasing the evaporative power of boilers. This Mr. Williams effects by studding the boiler plates with wrought-iron pins, made of ¾ inch round iron, and each 3 or 4 inches long; these are screwed into the boiler from the outside, or made slightly tapering and driven from the inside through holes drilled for the purpose, until they project within to only about 1 inch. This internal projection may be beaten down to a rivet head, thus providing for the easier cleaning of the boiler when incrusted with shelly deposit of carbonate of lime. The bottom of the boiler, together with the ends and sides exposed in the flues, may in this manner be bristled over with conducting pins 3 or 4 inches apart, giving an increased evaporative power up to 25 per cent., or more. A boiler of this description is an excellent absorbent of the heat, the flame and heated air impart their caloric to the pins, and these in like manner to the water, whereby ebullition is greatly promoted.

Another rapid and exceedingly ingenious steam generator is that invented by Mr. Andrew Smith, consisting of a cast-iron trough, in which a fusible alloy is kept at a temperature of from 400 to 500°; imbedded in this melted metal is a wrought-iron tube of 1 or 2 inches diameter, bent to a serpentine or zigzag form, and protruding at each end of the trough. The whole of this arrangement is inclosed in a furnace in which coal or coke may be burnt, presenting great economy of space from not being more than one-tenth the usual dimensions. Supposing one end of the serpentine tube to be connected with the steam-pipe of an engine, the other end would have attached to it a force pump, and as often as water is forced into the serpentine pipe, the whole is immediately converted into steam, and escapes under such pressure as is provided at the other extremity of the pipe. In this operation the force pump may be worked constantly, or at any stated intervals, as there is not the usual danger attending the absence of water in the boiler, which is perhaps the most striking and characteristic feature in this invention. The fusible metal melting at 300°, and taking up heat 32 times more rapidly than water, is a constant reservoir of heat, which the water forced through the bent tubing cannot exhaust, when properly proportioned to the work required. The foregoing remarks contain hints which it is hoped will be found interesting and useful to all who are concerned in pharmaceutical operations on a large scale, as pointing out means, both scientific and economical, for the production and application of heat, whether for steam power or otherwise. The object of these improvements is to obtain the combustion and heating effect of that gas which, in ordinary furnaces, is wasted, to impart to boilers that heat which usually escapes, and to produce the largest quantity of steam on a small scale of boiler and furnace with certainty and safety.

77, King William-street, City,
October, 1843.

* "The Combustion of Coal," illustrated with coloured diagrams, by C. W. Williams. 8vo. Second Edition. Simpkin, 1841. Pp 184.

IMPROVED STEAM GENERATOR.

(*Patented by* MR. A. SMITH, *Princes-street, Leicester-square.*)

As an apparatus for the more rapid generation of steam for engines than can be effected by any of the variety of boilers hitherto invented, when the fire is merely in contact with the outside of the tubes or vessel containing water, was some two years since patented by Mr. Andrew Smith, but from the increase of business connected with the introduction of the patent wire-rope demanding close attention, the "steam-generator" has not been sufficiently brought before the public, and we believe is but little known. The principle is simple, but highly effective; instead of the fire acting at once on the vessel containing the water, a body of metal capable of dissolving at not less than 300° Fahrenheit, is employed as a medium between the fire and generating tubes. An iron vessel is set in connection with the furnace on the same principle as a common boiler; near the bottom a series of iron tubes run the whole length of the vessel, and forming one continuous channel, one end is connected to the force-pump attached to the engine, and the other with a series of steam receivers, all connected, and to which the safety-valve is applied in the usual way.

A compound metal in due proportions, consisting of bismuth, lead, and zinc, is placed in the vessel in sufficient quantity to form a complete metallic bath, covering the generating tubes, but not to reach the receivers; this molten bath is generally kept up to a heat of about 500°, and the pump is so regulated to the size of the generator and power required, that at each stroke of the piston of the engine only sufficient water is injected into the tubes to supply steam for one revolution of the crank attached. On the injection of the water into the heated tubes, it is instantaneously converted into steam, passes into the steam receivers, and from thence to the engine cylinder, when, having performed its duty, the stroke of the piston injects another sufficient portion of water for the next stroke—thus keeping the receivers continually supplied, without an accumulation of more steam than is absolutely necessary for the proper performance of the engine. The great advantages afforded by this generator are, economy of fuel—less variation in the heat of the tubes, and, consequently, greater regularity in working—and the absolute safety from bursting, 1,000 lbs., at least, per square inch, being required to fracture one of the tubes, and should such circumstances by any chance occur, it would have no effect beyond the interior of the bath, and a new set of tubes could be inserted in a very short space of time. The small space occupied by this apparatus, in comparison with any of the old boilers, being about one-twentieth the usual size, is of much importance, and we recommend an inspection by all persons employing steam-engines.

By way of further comment, we cannot help considering this invention as one of the most ingenious and useful of the day. The economy of space is immense, and the equalization of temperature much more complete than has hitherto been attained—a point of extreme importance when the cost of fuel is taken into account.

FONT, PORTISHEAD CHURCH.

W. BENNETT presents his respects to the Editor of THE BUILDER, and has sent him the above drawing of the stone font. Portishead†, and should it be deemed worthy a place in THE BUILDER, it is quite at his service. He will please to make due allowance for any imperfection, when he knows it is from an unin-structed hand. Should this find favour, he may try his hand again at a very good Norm an doorway in Portbury Church, the next parish to Portishead.

Tring, 10th Month, 10th, 1843.

The *Presse Industrielle* mentions the accidental discovery of a mode for preventing the calcareous deposits being formed in the boilers of steam-engines. A sawyer of mahogany in the Faubourg Saint-Antoine, whose machinery is worked by steam, perceived a short time since, on opening the boiler to have it cleaned, that there was no deposit whatever, but that some mahogany sawdust had by chance been introduced. He has since then repeated the experiment, and found that in all cases the sawdust keeps the boiler clean.

† Portishead.—Parish in hundred of Portbury, Somerset, 8½ miles N.N.W. of Bristol, 508 inhabitants—a rectory.

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